

Department of the Interior
U.S. Geological Survey

LANDSAT 5 INTERNATIONAL GROUND STATIONS (IGS) INTERFACE CONTROL DOCUMENT (ICD)

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Section 1 Introduction

1.1 Scope

This Interface Control Document (ICD) establishes and records the requirements and the communications protocol for the scheduling of image data downlinks from the Landsat 5 satellite.

1.2 Purpose

The purpose of the ICD is to outline the downlink planning process and to specify the format and content of the various messages exchanged among the United States Geological Survey (USGS), the Landsat 5 Mission Operations Center (MOC), and the International Ground Station (IGS) to schedule and implement the downlink of image data from the Landsat 5 satellite.

1.3 Applicability

The requirements specified in the ICD shall be in effect for the operational period defined in the Service Agreement between USGS and the IGS for the downlink of image data from the Landsat 5 satellite.

Section 2 Interface Requirements

2.1 Scheduling Timeline

2.1.1 Weekly Timeline

The weekly timeline established for successful scheduling of the downlink of image data from the Landsat 5 satellite on a routine basis is shown on Figure 3-1. Messages containing the information specified herein shall be exchanged between USGS, Landsat 5 Scheduling Department and the IGS as illustrated in the Weekly Timeline.

2.1.2 Emergency Timeline

The emergency timeline established for successful scheduling of downlink of image data from the Landsat 5 satellite is shown on Figure 3-2. A tasking fee may apply to any request submitted within 5 working days of the planned acquisition. Requests for acquisition are not accepted within 2 days of the planned acquisition. Messages containing the information specified herein shall be exchanged between USGS Flight Operations System Manager, the Landsat 5 Scheduling Department and the IGS as illustrated in the Emergency Timeline.

2.2 Operational Interface Requirements

2.2.1 Service Request Message

The Service Request Message (SRVREQ) shall be used to request the acquisition and transmission of all image data to the IGS. This message shall be in the format described in Figure 3-3 and defined in Table 3-1. The service request message shall be received by USGS Flight Operations System Manager and the Landsat 5 Scheduling Department no later than eleven (11) days prior to the first day of the target week.

2.2.2 Service Schedule Message

The Service Schedule Message (SRVSCH) shall be used by Landsat 5 Scheduling Department to schedule the acquisition and transmission of all image data to the IGS. This message shall be in the format described in Figure 3-4 and defined in Table 3-2. The service schedule message shall be transmitted by Landsat 5 MOC to the IGS at least three (3) days prior to the first day of the target week. The service schedule message contains all image acquisition for the IGS covering a period of seven (7) days beginning on Monday of the following week and continuing until Sunday.

2.2.3 Spacecraft Orbital Elements

Landsat 5 MOC shall provide spacecraft orbital elements to the IGS for the purpose of spacecraft tracking. Spacecraft elements are available in the NORAD 2-line element (NORAD) format, The Improved Inter-Range Vector format (IIRV), and short form Brouwer Mean Element format (SFBME) . The orbital elements shall be transmitted by Landsat 5 MOC to the IGS daily. The epoch of the orbital elements represents the start of the orbit determination that was used to generate the elements. All orbital element messages shall contain spacecraft position and velocity vectors for the given epoch. The NORAD, IIRV and SFBME shall be in the format described in Figure 3-5, Figure 3-6 and Figure 3-7 respectively. These formats are defined in Table 3-3, Table 3-4, and Table 3-5, respectively.

Section 3 Notes

3.1 Communications

Landsat 5 MOC supports the following communications methods: phone, fax, ftp and e-mail. The IGS must identify, via e-mail to the Landsat 5 Scheduling Department, which of the four communication methods is to be used to communicate with the IGS. Table 3-12 lists the communications addresses, personnel points of contact, their office hours, and their area of responsibility.

3.2 Definitions

| TERM | DEFINITION |
|------------------|---|
| Acquisition day | The day for which image data is scheduled to be downlinked to the IGS |
| Acquisition week | The week of the scheduled acquisition beginning Monday and ending on Sunday |
| Target week | The week for which acquisitions are being planned. |

LANDSAT 5 WEEKLY TIMELINE

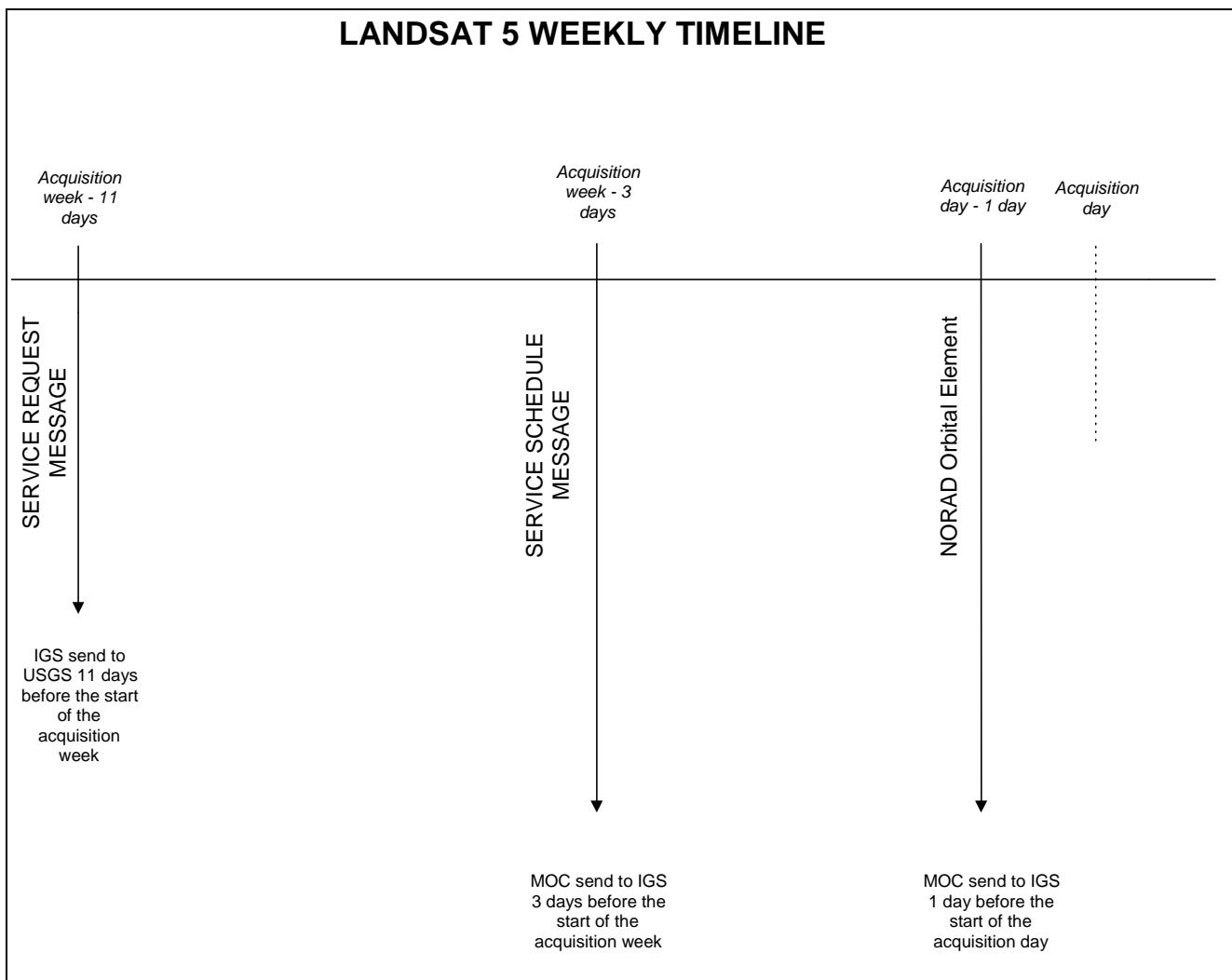


Figure 3-1. Landsat 5 Weekly Timeline

LANDSAT 5 EMERGENCY TIMELINE

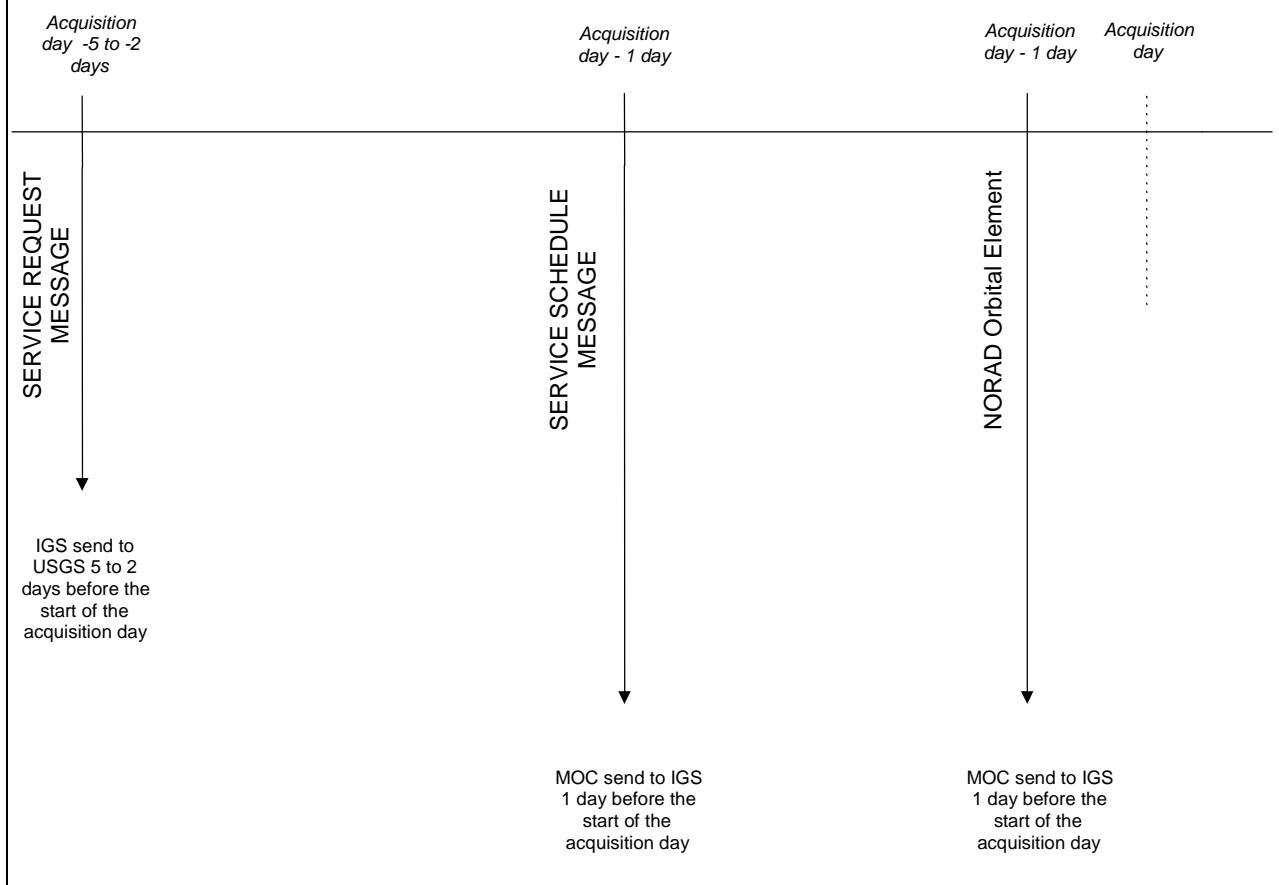


Figure 3-2. Landsat 5 Emergency Timeline

DEST: LAM
 ATTN: MISSION PLANNING
 ORIG: XXX
 FROM: AAAAAAAAAAAAAAAA
 TYPE: SRVREQ
 DTG: dd-mmm-yyyy hh:mm:ss
 SEQ: nnn

| DATE | S/C | PATH | START ROW | STOP ROW | SENSOR | TARGET LATITUDE | TARGET LONGITUDE |
|-------------|-----|------|--------------|-------------|--------|-----------------|------------------|
| dd-mmm-yyyy | LS5 | nnn | nnn | nnn | TM | deg*mn'sc.nn" A | deg*mn'sc.nn" B |

TEXTEND:

Figure 3-3. Service Request Message Format

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|---------|----------------------------------|---|
| 1 | 1-5 | keyword | DEST: | Destination field |
| 1 | 7-9 | value | LAM | Designator for Landsat 5 in Lanham, MD. |
| 2 | 1-5 | keyword | ATTN: | Attention field |
| 2 | 7-22 | value | MISSION <u>b</u> PLANNING | Recipient of the message |
| 3 | 1-5 | keyword | ORIG: | Originator field |
| 3 | 7-9 | value | XXX | Where XXX = IGS CODE |
| 4 | 1-5 | keyword | FROM: | From field |
| 4 | 7-27 | value | 21 character free-form | Department responsible for generating message. |
| 5 | 1-5 | keyword | TYPE: | Message Type field |
| 5 | 7-12 | value | SRVREQ | Message type for service request |
| 6 | 1-4 | keyword | DTG: | Date-Time-Group field |
| 6 | 7-29 | value | dd-mmm-yyyy <u>b</u> hh:mm:ss.ss | Where dd = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 2003-2010 hh = 00 to 23 mm = 00 to 59 ss.ss = 00.00 to 59.99 |
| 7 | 1-4 | keyword | SEQ: | Sequence number field |
| 7 | 7-9 | value | nnn | Where nnn = 001 to 999 |
| 8 | 1-4 | keyword | DATE | Date field |
| 8 | 17-19 | keyword | S/C | Satellite identification field |
| 8 | 24-27 | keyword | PATH | Flight path field |
| 8 | 32-36 | keyword | START | Start row field |
| 8 | 41-44 | keyword | STOP | Stop row field |

Table 3-1. Service Request Message Format Definition (1 of 2)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------------------|--------|---------|-------------------------------|---|
| 8 | 48-53 | keyword | SENSOR | Payload sensor field |
| 8 | 57-72 | keyword | TARGET <u>b</u> LATITUDE | Latitude coordinate of the target field |
| 8 | 81-96 | keyword | TARGET <u>b</u> LONGITU DE | Longitude coordinate of the target field |
| 9 | 32-34 | keyword | ROW | Start row field |
| 9 | 41-43 | keyword | ROW | Stop row field |
| 10-n | 1-11 | value | dd-mmm-yyyy | Acquisition date where dd = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 2003 - 2010 |
| 10-n | 17-19 | value | LS5 | Satellite identification |
| 10-n | 24-26 | value | nnn | Flight path where nnn = 001 to 233 |
| 10-n | 32-34 | value | nnn | Start row where nnn = 001 to 248 |
| 10-n | 41-43 | value | nnn | Stop row where nnn = 001 to 248 |
| 10-n | 48-49 | value | TM | Payload sensor |
| 10-n | 57-71 | value | deg*mn ' sc.nn" <u>b</u> A | Target latitude where deg = 000 to 180 mn = 00 to 59 sc = 00 to 59 nn = 00 to 99 A = N (North) or S (South) |
| 10-n | 81-95 | value | deg*mn ' sc.nn" <u>b</u> B | Target longitude where deg = 000 to 180 mn = 00 to 59 sc = 00 to 59 nn = 00 to 99 B = E (East) or W (West) |
| n+1 | 1-8 | keyword | TEXTEND: | Signifies the end of the message |
| <u>b</u> = blank | | | | |

Table 3-2. Service Request Message Format Definition (2 of 2)

```
ZCZCUS 6ddd.nnn AKU
*
DEST: ddd
ATTN: A21
ORIG: LAM
FROM: Operations
TYPE: SRVSCH
DTG: dd-mmm-yyyy hh:mm:ss
SEQ: nnn
AAA 5 d1-mmm-yyyy hh:mm:ss d2-mmm-yyyy hh:mm:ss SSSS OOOOO PPP +0.0
TEXTEND:
```

Figure 3-4. Service Schedule Message Format

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|---------|---|---|
| 1 | 1-19 | keyword | ZCZCUS <u>b</u> 6ddd.nnn <u>b</u> AK U | Commercial carrier tracking code Where ddd = IGS CODE Where nnn = 001 to 999 |
| 2 | 1 | keyword | * | |
| 3 | 1-5 | keyword | DEST: | Destination field |
| 3 | 7-9 | value | ddd | Where ddd = IGS CODE |
| 4 | 1-5 | keyword | ATTN: | Attention field |
| 4 | 7-27 | value | 21 character free form | Recipient of the message |
| 5 | 1-5 | keyword | ORIG: | Originator field |
| 5 | 7-9 | value | LAM | The designator for Landsat 5 in Lanham, Md. |
| 6 | 1-5 | keyword | FROM: | From field |
| 6 | 7-22 | value | Operations | Department responsible for generating message. |
| 7 | 1-5 | keyword | TYPE: | Message Type field |
| 7 | 7-12 | value | SRVSCH | Message type for service schedule |
| 8 | 1-4 | keyword | DTG: | Date-Time-Group field |
| 8 | 7-29 | value | dd-mmm- yyyy <u>b</u> hh:mm:ss.ss | Where dd = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 2003-2010 hh = 00 to 23 mm = 00 to 59 ss.ss = 00.00 to 59.99 |
| 9 | 1-4 | keyword | SEQ: | Sequence number field. Increments by one as new message is generated. |
| 9 | 7-9 | value | nnn | Where nnn = 001 to 999 |

b = blank

Table 3-3. Service Schedule Message Format Definition (1 of 2)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------------------|--------|---------|----------------------------------|--|
| 10-n | 1-3 | value | AAA | Receiving station Where AAA = IGS CODE |
| 10-n | 5 | value | 5 | Spacecraft ID |
| 10-n | 7-26 | value | d1-mmm- yyyy hh :mm:ss | Payload On time Where d1 = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 2003-2010 hh = 00 to 23 mm = 00 to 59 ss = 00 to 59 |
| 10-n | 28-47 | value | d2-mmm- yyyy hh :mm:ss | Payload Off time Where d2 = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 2003-2010 hh = 00 to 23 mm = 00 to 59 ss = 00 to 59 |
| 10-n | 49-52 | value | SSSS | Sensor Where SSSS = TM b |
| 10-n | 54-58 | value | OOOOO | Orbit number Where OOOOO = 00001 to 99999 |
| 10-n | 60-62 | value | PPP | Path number Where PPP = 001 to 233 |
| 10-n | 64-67 | value | +0.0 | Pan tilt angle |
| n+1 | 1-8 | keyword | TEXTEND: | Field signifying the end of the message |
| <u>b</u> = blank | | | | |

Table 3-4. Service Schedule Message Format Definition (2 of 2)

ZCZCUS 6ddd.nnn AKU
*
DEST: ddd
ATTN: STATION OPERATOR
ORIG: LAM
FROM: Operations
TYPE: NORAD
DTG: dd-mmm-yyyy hh:mm:ss
SEQ: nnn
1 14780U 84021A yyddd.fffffff sfffffff smmmmm-m sbbbbb-b 0 eeeeec
2 14780 iii.iiii raa.aaaa eeeeeee ppp.pppp mmm.mmmm rr.rrrrrrrrrooooooc
TEXTEND:

Figure 3-5. Norad Two Line Elements Message Format

DEST: ddd
ATTN: STATION OPERATOR
ORIG: LAM
FROM: Operations
TYPE: IIRV
DTG: dd-mmm-yyyy hh:mm:ss
SEQ: nnn
Landsat 5 IIRV from EOSAT
GIIRV MANY
0011141901sssdoyhmmsssscs
axxxxxxxxxxssyyyyyyyyyysszzzzzzzz
axxxxxxxxxxssyyyyyyyyyysszzzzzzzz
mmmmmmmmmaaaaakkkksrrrrrrrcs
ITERM
TEXTEND:

Figure 3-6. LIRV Message Format

DEST: IGS
ATTN: STATION OPERATOR
ORIG: LAM
FROM: Operations
TYPE: SFBME
DTG: dd-mmm-yyyy hh:mm:ss
SEQ: nnn
LNDSAT-5 8402101 E yyymmdd. hhmmss.sss
smx xxxx.xxxx ecc e.eeeeeeee inc ii.iiii rAA rr.rrrr
LnA' l.1111 Arp aaa.aaaa Arp' sa.aaaa Man mmm.mmmm
P pp.pppp pht hhh.hhhh aht aaa.aaaa
vp p.pppp va v.vvvv Ltp s11.1111
eLn eee.eeee gLt gg.gggg ht hhh.hhhh
x sxxxx.xxxxxxxx y syyyy.yyyyyyyy z szzzz.zzzzzzzz
x' sx.xxxxxxxx y' sy.yyyyyyyy z' sz.zzzzzzzz
TEXTEND:

Figure 3-7. SFBME Message Format

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------------------|--------|---------|---|---|
| 1 | 1-19 | keyword | ZCZCUS <u>b</u> 6ddd.nnn <u>b</u> AK U | Commercial carrier tracking code Where ddd = IGS CODE Where nnn = 001 to 999 |
| 2 | 1 | keyword | * | |
| 3 | 1-5 | keyword | DEST: | Destination field |
| 3 | 7-9 | value | ddd | Where ddd = IGS CODE |
| 4 | 1-5 | keyword | ATTN: | Attention field |
| 4 | 7-22 | value | STATION <u>b</u> OPERATOR | Recipient of the message |
| 5 | 1-5 | keyword | ORIG: | Originator field |
| 5 | 7-9 | value | LAM | The designator for Landsat 5 in Lanham, MD. |
| 6 | 1-5 | keyword | FROM: | From field |
| 6 | 7-16 | value | Operations | Department responsible for generating message. |
| 7 | 1-5 | keyword | TYPE: | Message Type field |
| 7 | 7-11 | value | NORAD | Message type for NORAD 2-line element |
| 8 | 1-4 | keyword | DTG: | Date-Time-Group field |
| 8 | 7-29 | value | dd-mmm- yyyy <u>b</u> hh:mm:ss.ss | Where dd = 01 to 31 mm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 0000 to 9999 hh = 00 to 23 mm = 00 to 59 ss.ss = 00.00 to 59.99 |
| 9 | 1-4 | keyword | SEQ: | Sequence number field |
| 9 | 7-9 | value | nnn | Where nnn = 001 to 999 |
| 10 | 1 | value | 1 | line number |
| 10 | 3-7 | value | 14780 | NORAD satellite ID |
| 10 | 8 | value | U | U = Unclassified mission |
| 10 | 10-15 | value | 84021A | International designator |
| <u>b</u> = blank | | | | |

Table 3-5. Norad Two Line Element Format Definition (1 of 2)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|-------|----------------|---|
| 10 | 19-32 | value | yyddd.fffffff | epoch of the element where yy = last two digits of year (00 to 99) ddd = Julian day (001 to 366) fffffff = fraction of day (00000000 to 99999999) |
| 10 | 34-43 | value | sfffffff | First derivative of mean motion Where s = blank if positive, – if negative |
| 10 | 45-52 | value | smmmmm-m | Second derivative of mean motion Where s = blank if positive, – if negative |
| 10 | 54-61 | value | sbbbb-b | Decimal point is assumed, usually zero-filled BSTAR drag term Where s = blank if positive, – if negative |
| 10 | 63 | value | 0 | Decimal point is assumed |
| 10 | 65-68 | value | eeee | Mean inertial ephemeris |
| 10 | 69 | value | c | element number (0001 to 9999) line checksum where c = 0 to 9 (modulo 10) |
| 11 | 1 | value | 2 | line number |
| 11 | 3-7 | value | 14780 | NORAD satellite ID |
| 11 | 9-16 | value | iii.iiii | inclination in degrees where iii.iiii = 098.0000 to 098.5000 |
| 11 | 18-25 | value | raa.aaaa | right ascension of ascending node where raa.aaaa = 000.0000 to 360.0000 |
| 11 | 27-33 | value | eeeeeee | Eccentricity (assumed decimal at left) |
| 11 | 35-42 | value | ppp.pppp | Argument of perigee in degrees Where ppp.pppp = 075.0000 to 100.0000 |
| 11 | 44-51 | value | mmm.mmmm | Mean anomaly in degrees Where mmm.mmmm = 000.0000 to 360.0000 |
| 11 | 53-63 | value | rr.rrrrrrrr | Mean motion (revolutions per day) Where rr.rrrrrrrr = 00.00000000 to 99.99999999 |
| 11 | 64-68 | value | ooooo | orbit number at epoch where ooooo = 00001 to 99999 |
| 11 | 69 | value | c | line checksum where c = 0 to 9 (modulo 10) |
| 12 | 1-8 | keywo | TEXTEND: rd | Field signifying the end of the message |

b = blank

Table 3-6. Norad Two Line Element Format Definition (2 of 2)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|---------|--|---|
| 1 | 1-5 | keyword | DEST: | Destination field |
| 1 | 7-9 | value | ddd | Where ddd = IGS CODE |
| 2 | 1-5 | keyword | ATTN: | Attention field |
| 2 | 7-22 | value | STATION <u>b</u> OPERATOR | Recipient of the message |
| 3 | 1-5 | keyword | ORIG: | Originator field |
| 3 | 7-9 | value | LAM | The designator for Landsat 5 in Lanham, MD. |
| 4 | 1-5 | keyword | FROM: | From field |
| 4 | 7-16 | value | Operations | Department responsible for generating message. |
| 5 | 1-5 | keyword | TYPE: | Message Type field |
| 5 | 7-11 | value | NORAD | Message type for NORAD 2-line element |
| 6 | 1-4 | keyword | DTG: | Date-Time-Group field |
| 6 | 7-29 | value | dd-mmm-yyyy <u>b</u> hh:mm:ss.ss | Where dd = 01 to 31 mm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 0000 to 9999 hh = 00 to 23 mm = 00 to 59 ss.ss = 00.00 to 59.99 |
| 7 | 1-4 | keyword | SEQ: | Sequence number field |
| 7 | 7-9 | value | nnn | Where nnn = 001 to 999 |
| 8 | 1-25 | keyword | Landsat | Orbital Element Description |
| | | | 5 <u>b</u> IIRV <u>b</u> from <u>b</u> EOSAT | |
| 9 | 1-5 | keyword | GIIRV | Message start |
| 9 | 7-10 | keyword | MANY | Routing indicator (multiple destinations) |
| 10 | 1 | value | 0 | Vector type (free flight, routine on-orbit) |
| 10 | 2 | value | 0 | Data source (nominal/planning) |
| 10 | 3 | value | 1 | Transfer type (Interrange) |
| 10 | 4 | value | 1 | Coordinate system (Geocentric true-of-date rotation) |

b = blank

Table 3-7. LIRV Format Definition (1 of 3)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|-------------|---------------|-------------|--------------------|---|
| 10 | 9-10 | value | 01 | Vehicle Identification Code |
| 10 | 11-13 | value | 000 | Sequence number incremented for each vector in a set of vector data. Fixed for Landsat 5 |
| 10 | 14-16 | value | doy | Day of year (001 – 366) |
| 10 | 17-25 | value | hhmmsssss | Vector epoch in UTC where hh = 00 – 23 (hours) mm = 00 – 59 (minutes) sssss = 00000 – 59999 (milliseconds – implied decimal is three places from the right) |
| 10 | 26-28 | value | csm | Checksum for line 12; calculated by summing the decimal equivalent of the preceding characters in the line, counting spaces as 0 and negative signs as 1 |
| 11 | 1-13 | value | sxxxxxxxxxxxx | X component of the position vector in meters s = “-“ for negative sign or ASCII space for positive sign |
| 11 | 14-26 | value | syyyyyyyyyyyy | Y component of the position vector in meters s = “-“ for negative sign or ASCII space for positive sign |
| 11 | 27-39 | value | szzzzzzzzzzz | Z component of the position vector in meters s = “-“ for negative sign or ASCII space for positive sign |
| 11 | 40-42 | value | csm | Checksum for line 13 |
| 12 | 1-13 | value | sxxxxxxxxxxxx | X component of the velocity vector in meters per second, with a resolution to the nearest millimeter per second; assumed decimal point is three places from the right. a = “-“ for negative sign or ASCII space for positive sign |
| 12 | 14-26 | value | syyyyyyyyyyyy | Y component of the velocity vector in meters per second s = “-“ for negative sign or ASCII space for positive sign |
| 12 | 27-39 | value | szzzzzzzzzzz | Z component of the velocity vector in meters per second s = “-“ for negative sign or ASCII space for positive sign |

b = blank

Table 3-8. LIRV Format Definition (2 of 3)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------------------|---------------|-------------|--------------------|---|
| 13 | 1-8 | value | mmmmmmmm | Mass of the satellite in kilograms with a resolution to the nearest tenth of a kilogram; assumed decimal point is one place from the right. Must contain all zeros if not used. |
| 13 | 9-13 | value | aaaaaa | Average satellite cross-sectional area in square meters with a resolution to the nearest hundredth of a square meter; assumed decimal point is two places from the right. Must contain all zeros if not used. |
| 13 | 14-17 | value | kkkk | Dimensionless drag coefficient; assumed decimal point is two places from the right. Must contain all zeros if not used |
| 13 | 18-25 | value | srrrrrrr | Dimensionless solar reflectivity coefficient; assumed decimal point is six places from the right. Must contain all zeros if not used |
| 13 | 26-28 | value | csm | Checksum for line 15 |
| 14 | 1-5 | value | ITERM | Indicates end of message |
| 15 | 1-8 | value | TEXTEND: | End of transmission |
| <u>b</u> = blank | | | | |

Table 3-9. LIRV Format Definition (3 of 3)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|---------|----------------------------------|--|
| 1 | 1-5 | keyword | DEST: | Destination field |
| 1 | 7-9 | value | ddd | Where ddd = IGS CODE |
| 2 | 1-5 | keyword | ATTN: | Attention field |
| 2 | 7-22 | value | STATION <u>b</u> OPERATOR | Recipient of the message |
| 3 | 1-5 | keyword | ORIG: | Originator field |
| 3 | 7-9 | value | LAM | The designator for Landsat 5 in Lanham, Md. |
| 4 | 1-5 | keyword | FROM: | From field |
| 4 | 7-16 | value | Operations | Department responsible for generating message. |
| 5 | 1-5 | keyword | TYPE: | Message Type field |
| 5 | 7-11 | value | SFBME | Message type for SFBME |
| 6 | 1-4 | keyword | DTG: | Date-Time-Group field |
| 6 | 7-29 | value | dd-mmm-yyyy <u>b</u> hh:mm:ss.ss | Where dd = 01 to 31 mmm = JAN, FEB, MAR, APR, MAY, JUN, JUL, AUG, SEP, OCT, NOV, DEC yyyy = 0000 to 9999 hh = 00 to 23 mm = 00 to 59 ss.ss = 00.00 to 59.99 |
| 7 | 1-4 | keyword | SEQ: | Sequence number field |
| 7 | 7-9 | value | nnn | Where nnn = 001 to 999 |
| 8 | 2-9 | value | LNDSAT-5 | Satellite ID |
| 8 | 11-17 | value | 8402101 | International designator |
| 8 | 21-27 | value | yyymmdd | Time tag |
| 9 | 2-4 | keyword | smx | Semi Major Axis |
| 9 | 6-14 | value | xxxx.xxxx | value |
| 9 | 16-18 | keyword | ecc | Eccentricity |
| 9 | 20-29 | value | e.eeeeeeee | value |
| 9 | 31-33 | keyword | inc | Inclination |

b = blank

Table 3-10. SFBME Format Definition (1 of 2)

| LINE | COLUMN | ITEM | DESCRIPTION | DEFINITION |
|------|--------|---------|-----------------|----------------------------------|
| 9 | 43-45 | keyword | rAA | R.A. of Ascending Node |
| 9 | 47-53 | value | rr.rrrr | value |
| 10 | 2-5 | keyword | LnA' | Longitude of Ascending Node Rate |
| 10 | 7-12 | value | l.llll | value |
| 10 | 14-16 | keyword | Arp | Argument of Perigee |
| 10 | 18-25 | value | aaa.aaaa | value |
| 10 | 28-31 | keyword | Arp' | Argument of Perigee Rate |
| 10 | 33-39 | value | (+/-)a.aaaa | value |
| 10 | 41-43 | keyword | Man | Mean Anomaly |
| 10 | 45-52 | value | mmm.mmmm | value |
| 11 | 2 | keyword | P | Period |
| 11 | 4-10 | value | pp.pppp | value |
| 11 | 12-14 | keyword | pht | Height of Perifocus |
| 11 | 16-23 | value | hhh.hhhh | value |
| 11 | 25-27 | keyword | aht | Height of Apofocus |
| 11 | 29-36 | value | aaa.aaaa | value |
| 12 | 2-3 | keyword | vp | Velocity at Perigee |
| 12 | 5-10 | value | p.pppp | value |
| 12 | 12-13 | keyword | va | Velocity at Apogee |
| 12 | 15-20 | value | v.vvvv | value |
| 12 | 22-24 | keyword | Ltp | Perigee Latitude |
| 12 | 26-33 | value | (+/-)ll.llll | value |
| 13 | 2-4 | keyword | eLn | East Longitude |
| 13 | 6-13 | value | eee.eeee | value |
| 13 | 15-17 | keyword | gLt | Geodetic Latitude |
| 13 | 19-25 | value | gg.gggg | Value |
| 13 | 30-37 | value | hhh.hhhh | value |
| 14 | 2 | keyword | x | X Value of Position Vector |
| 14 | 4-16 | value | xxxx.xxxxxxxx | value |
| 14 | 18 | keyword | y | Y Value of Position Vector |
| 14 | 20-32 | value | yyyy.yyyyyyyy | value |
| 14 | 34 | keyword | z | Z Value of Position Vector |
| 14 | 36-48 | value | zzzz.zzzzzzzz | value |
| 15 | 2-3 | keyword | x' | X Value of Velocity Vector |
| 15 | 5-15 | value | (+/-)x.xxxxxxxx | value |
| 15 | 18-19 | keyword | y' | Y Value of Velocity Vector |
| 15 | 21-31 | value | (+/-)y.yyyyyyyy | value |
| 15 | 34-35 | keyword | z' | Z Value of Velocity Vector |
| 15 | 37-46 | value | (+/-)z.zzzzzzzz | value |
| 16 | 1-8 | keyword | TEXTEND: | Signifies the End of the Message |

b = blank

Table 3-11. SFBME Format Definition (2 of 2)

LANDSAT 5 MISSION OPERATIONS CENTER (LMOC)

Destination: LAM

Mailing Address: LANDSAT 5
4300 Forbes Blvd.
Lanham, MD. 20706 USA

FAX Number: 001-301-577-7865

E-Mail Address: L5FOT@csc.com

Points of Contact

| <u>Area of Responsibility</u> | <u>Name</u> | <u>Number</u> | <u>Business Hours</u> |
|-------------------------------|---------------------------|--|--|
| Landsat Control Center | Flight Controller on duty | phone: 001-301-429-6611 FAX: 001-301-577-7865 e-mail: l5fot@csc.com | (Oct. - Apr.) 1215z - 0645z (Apr. - Oct.) 1115z - 0545z |
| Mission Scheduling: | Dottie Seitz | phone: 001-301-429-6608 FAX: 001-301-577-7865 e-mail: dseitz@csc.com | (Oct. - Apr.) 1300z - 2200z (Apr. - Oct.) 1200z - 2100z |
| Director, Operations | K.C. Leung | Phone: 001-301-794-4059 FAX: 001-301-794-8380 e-mail: kleung@csc.com | (Oct. - Apr.) 1300z - 2200z (Apr. - Oct.) 1200z - 2100z |

Table 3-12. Landsat 5 Points of Contact

Appendix A Acronyms

| | |
|-----------|--|
| ASCII | American Standard Code for Information Interchange |
| ATTN | Attention |
| BSTAR | Drag-related parameter in the NORAD 2-line element message |
| deg, DEG. | Degree |
| DEST | Destination |
| DOC | Document |
| DTG | Date-Time Group |
| ftp | file transfer protocol |
| GS | Ground Segment |
| ICD | Interface Control Document |
| ID | Identification |
| IGS | International Ground Station |
| IIRV | Improved Inter-Range Vector |
| LAM | Lanham, Maryland USA |
| LFO | Landsat 5 Flight Operations |
| LS5 | Landsat 5 |
| Md. | Maryland |
| MOC | Mission Operations Center |
| NORAD | North American Air Defense |
| ORIG | Originator |
| R.A. | Right Ascension |
| REV | Revision |
| S/C | Spacecraft |
| SEQ | Sequence |
| SFBME | Short Form Brouwer Mean Element |
| SRVREQ | Service Request Message |
| SRVSCH | Service Schedule Message |
| TM | Thematic Mapper |
| USGS | United States Geological Survey |

UTC

Coordinated Universal Time

z

Zulu Time

References

The latest published version of these documents shall apply. They are available at:

<http://landsat7.usgs.gov/igsdocs15.php>

LS-PD-20. USGS / LANDSAT 5 Downlink Authorization Policy.